



Putting Children's Environmental Health in Social Context: Why Communities Matter

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How Do Social and Physical 'Toxicants' Get Under Your Skin?

housing problems

threats to safety

multiple pollutants

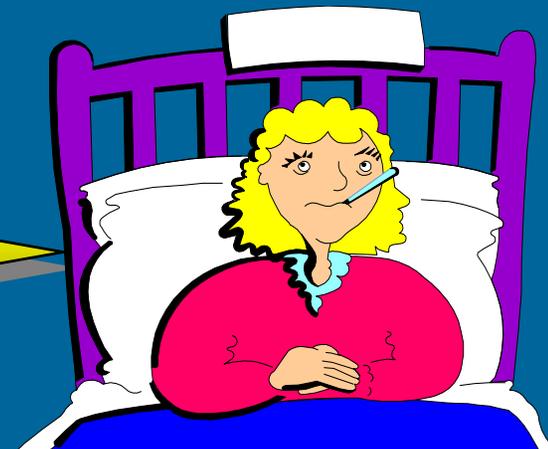
stress

deprivation

conflict



Black Box



Mother and Child

Columbia Center for Children's Environmental Health

Science

Exposures: e.g. PAH, particulate matter, environmental tobacco smoke, pesticides, allergens



■ ▲ **Biomarkers:** e.g. DNA damage from PAH, cotinine, lead, pesticide concentrations, immune changes

Birth outcomes, child development,
asthma, cancer risk

Environmental exposures and social context: context:

- **Environmental pollutants are disproportionately distributed in society**
- **Pollutants rarely occur in isolation, so that environmental risk is often cumulative**
- **Processes thought to link social conditions and health frequently involve adverse health behaviors such as smoking, alcohol, poor dietary practices and other toxic exposures**

Environmental exposures and social context (cont.): (cont.):

- **Social and physically toxic exposures are both ‘stressful’, sharing common biological pathways involving neuroendocrine and immune system functioning**
- **Emerging evidence that physically toxic exposures interact with social adversity to exacerbate illness**



Progress and Key Findings

- Prenatal PAH exposure is associated with decreased birthweight and head circumference among African American infants
- Prenatal chlorpyrifos exposure (a non-persistent pesticide) is associated with decreased birthweight among African Americans and reduced birth length in total sample

Hypotheses

1. Prenatal exposure to ETS will be associated with deficits in early child cognitive development
2. Chronic exposure to social adversity will be associated with deficits in early child cognitive development
3. Chronic exposure to social adversity will exacerbate the harmful impact of ETS, after adjustment for other biomedical and demographic risks



Who is participating in the mothers and newborns study?

- About 600 women and their babies living in Washington Heights, Central Harlem and the South Bronx
- They have agreed to be interviewed during pregnancy, provide blood samples, and have their apartments tested for dust and air pollution
- They have permitted us to test their children every year until the children start school

The children are African American and Hispanic, reflecting the race or ethnicity of the community residents



The Study Sample (n=226)

Eligibility criteria:

- Women aged 18-35, self-identified as African American or Dominican
- Registered for care by the 20th week of pregnancy at the OB/GYN clinics of New York Presbyterian Medical Center, Harlem Hospital or their satellite clinics between 4/98 and 10/02
- Non-smoking throughout pregnancy (initially screened by self report and validated by cotinine levels less than 25 ng/ml)
- Free of diabetes, hypertension and known HIV, documented or reported drug abuse
- Resided in the community for at least one year
- Complete antenatal exposure data, antenatal interview, blood samples, birth record, and developmental follow-up data

Data Collection

Personal interview

A 45-minute questionnaire was administered by a trained bilingual interviewer during the last trimester of pregnancy, at 6 months, 12 months, and 24 months postpartum. Content included: socioeconomic and demographic information, residential history, living conditions during the current pregnancy (including housing quality and material hardship), history of exposure to active and passive smoking, alcohol, drugs, and PAH-containing foods (frequency of consumption of blackened meat, chicken or fish).

Prenatal personal air monitoring

During third trimester, women were asked to wear a small backpack containing a personal monitor during the daytime hours for 2 consecutive days and to place the monitor near the bed at night. Personal air sampling pumps operated continuously over this period, collecting vapors and particles of ≤ 2.5 microns in diameter on a precleaned quartz microfiber filter and polyurethane foam cartridge backup.

Biologic samples

Maternal blood (30-35 ml) collected within 1 day postpartum; umbilical cord blood (30-60 ml) collected at delivery. Samples transported to the laboratory immediately, where buffy coat, packed red blood cells, and plasma samples were separated and stored at -70°C . Analyzed for plasma cotinine and lead.

Data Collection (cont.)

Measures of fetal growth

Gestational age, birth weight, birth length, and head circumference data were abstracted from maternal and infant medical records

Child neurodevelopment

The Bayley Scales of Infant Intelligence-II (Revised) were used to assess cognitive development at 24 months of age

Constructs

Material Hardship (Mayer & Jencks, 1988)

Unmet basic needs in the areas of food, housing, and clothing
clothing

Scores range from 0 to 3

Demoralization (Dohrenwend et al., 1978)

The 27-item Psychiatric Epidemiology Research Instrument was used to measure nonspecific psychological distress

Level and Distribution of Exposures

- Prenatal ETS exposure occurred in 39.1% of the sample
- Detectable inhalation levels of one or more PAH were found in 100% of the sample (total PAH exposures averaged 3.62 ng/m³, range = 0.27 to 36.47 ng/m³)
- Ingestion of dietary PAH was uncommon (4.9%)
- One or more material hardships were reported by 37.7% of women during pregnancy, 27.3% during the first postpartum year, 22.7% during the second postpartum year, and 9.2% at all three assessments
- Postnatal ETS exposure over the first two years of life was reported by 38.7% of mothers, both pre- and postnatal exposure was reported by 26.0%, and 21.7% had postnatal ETS exposure only.



Ethnic Differences in Patterns of Social Adversities and Chronic Social Stressors

	<u>Af. Americans</u>	<u>Dominicans</u>	<u>p -value</u>
Dilapidated Housing*	48.1%	38.7%	<.05
Material Hardships:			
Go without food	7.8%	25.0%	<.001
Go without housing	10.9%	28.7%	<.001
Go without clothing	18.1%	37.6%	<.001
Single parenthood	85.9%	54.7%	<.001

*Index of disrepair (holes in ceilings and walls, leaky pipes, water damage, peeling paint)

These differences exist despite similarities in educational level and income, across communities and ethnic groups



Relationship between social and physical toxicants in the northern Manhattan cohort

	<u>PAH</u>	<u>ETS</u>
Unmarried	ns	p<.05
Extreme poverty	ns	p<.01
Teenage mother	ns	p<.01
Educational level	ns	p<.05
Total social stressors	p<.05	p<.01
Floor level of residence	p<.05	ns
Pregnancy during heating season (October through May)	p<.001	ns

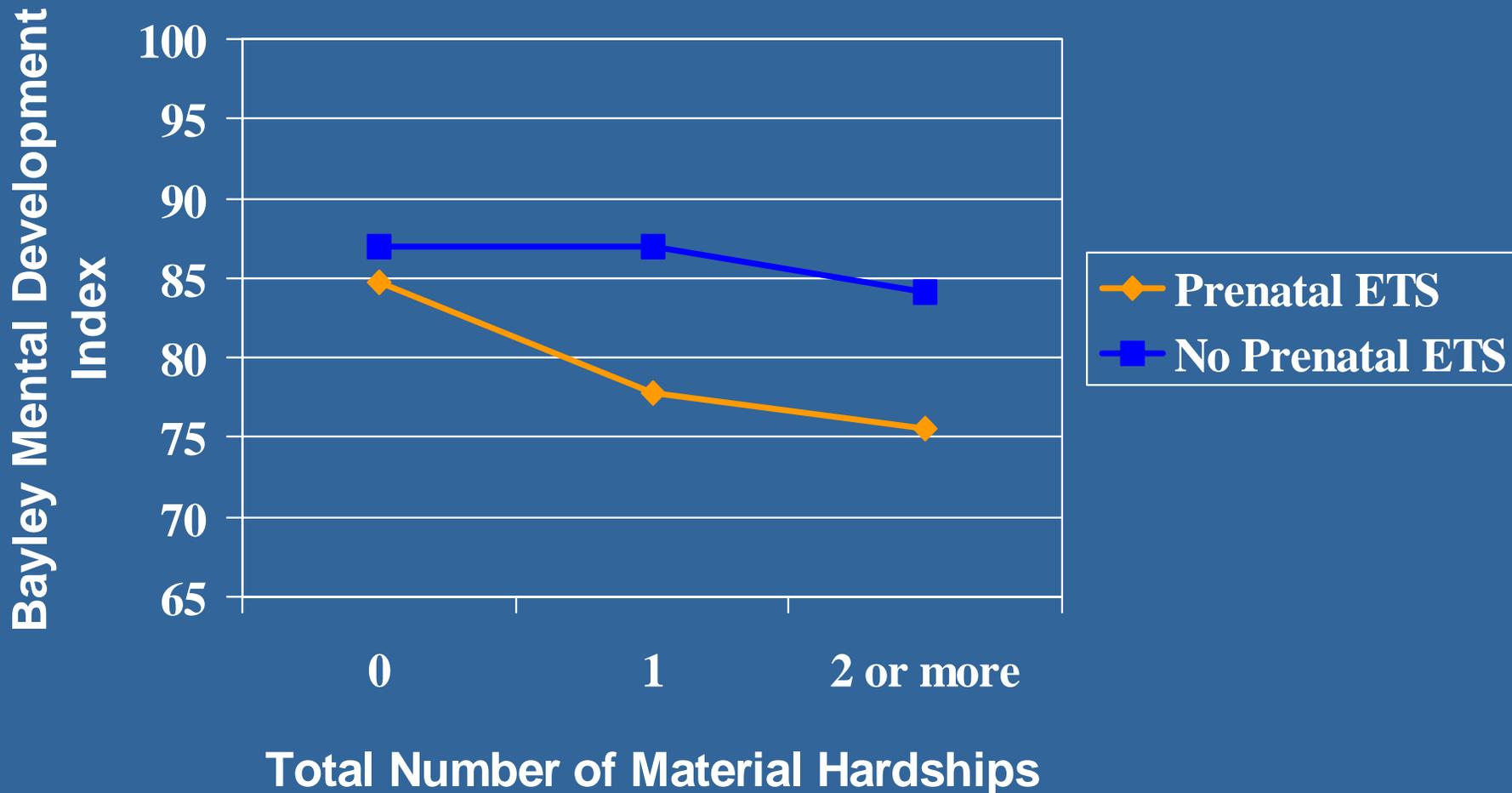
Results suggest that social and physical toxic exposures tend to co-occur, so that analyses of adverse effects must address confounding as well as possible interactions.



Developmental Outcomes: Bayley Scales

			% Delayed	
	<u>Mean</u>	<u>SD</u>	<u>Mild</u>	<u>Moderate</u>
12-month: (n=313)				
Mental Development	93.77	9.71	16.0 %	1.0 %
Motor Development	96.41	12.65	15.4%	1.6%
24-month: (n=193)				
Mental Development	84.16	12.61	39.4%	11.9%
Motor Development	97.36	12.11	12.0%	2.6%
36-month: (n=92)				
Mental Development	85.78	11.94	38.3%	9.6%
Motor Development	97.85	14.63	13.8%	6.4%

Regression^a of 24-month Cognitive Development on Prenatal ETS Exposure, by Level of Material Hardship



^aAdjusted for race/ethnicity, gender, gestational age at delivery, age at testing, marital status, maternal age, PAH exposure, and postnatal ETS

Summary of Results

1. Prenatal residential ETS exposure was associated with with a 5-point mean decrement in 2-year Bayley scores scores in this northern Manhattan sample
2. This 5-point decrement resulted in a two-fold risk of developmental delay (< 80) on the Bayley Scales
3. Exposure to prenatal ETS in the context of chronic material hardship (unmet basic needs) was associated associated with a 7-point decrement in 2-year Bayley, suggesting that the neurotoxic effects of ETS are increased under conditions of socioeconomic deprivation
4. The main effect of ETS on development was observed observed for prenatal but not postnatal exposure

What do these results mean?

Secondhand Smoke Effect:

- ETS effect is smaller than reported active prenatal smoking effects (Makin et al., 1991; Weitzman et al., 2002)
- ETS effect is comparable to the cognitive effects of prenatal low-level lead exposure in the preschool years, years, with cognitive effect sizes ranging from 3.4-6.6 points (e.g., Schwartz, 1994)
- Children with MDI scores below 80 are at increased risk risk for performance deficits in language, reading, and math in the early school years

Interaction of ETS and Material Hardship:

- Material hardship may be a marker for exposure to other unmeasured toxicants with possible synergistic effects (Mattson et al., 2002; Eyler et al., 1998)
- Individuals exposed to both ETS and material hardship may have a third risk factor in common with a direct adverse impact on development: dietary deficiency (Rogers et al., 1998)
- The ETS-material hardship interaction effect is comparable to lead-SES interaction effects (e.g., Weiss, 2000) or cocaine-SES interaction effects (Eyler et al., 1998)

*New York City
Mothers & Newborns Study*

**Protecting Your Children from
Environmental Pollutants**

What Can You Do?

Outdoor Air Pollution

What You Can Do

Join a clean air campaign in your community to help reduce air pollution.

Community action helped lead to the US government banning toxic pesticides from household products. Your activism can help get cleaner buses on local streets and prevent pollution sources from being put in your neighborhoods, such as diesel bus depots and waste transfer stations.

Tobacco Smoke

What You Can Do

Read and talk with your children regularly. This stimulates them to learn and do better in school.

Do not allow smoking in closed spaces such as the home or car when pregnant women and/or children are present.

When smoking is necessary, ask the smoker to smoke outdoors.

Help friends and family to quit smoking.

